Charge," Harvey Fletcher, University of Chicago.

"Note on a Form of Spectrophotometer," Edward L. Nichols and Ernest Merritt, Cornell University.

A. D. COLE,
Secretary, Section B

SECTION G—BOTANY

AT the convocation week meetings in Minneapolis, Section G held two sessions, one on Wednesday afternoon, December 28, and the other on Friday morning, December 30, under the vice-presidency of Professor R. A. Harper. Dr. William Crocker served as secretary in the absence of the regular secretary, Dr. Henry C. Cowles. The customary address of the retiring vice-president was necessarily omitted, owing to the death of Professor Penhallow. The program consisted of four special addresses and a number of technical papers, abstracts of which appear below.

The section unanimously adopted the following resolution regarding the death of Vice-president Penhallow: The botanists of the American Association for the Advancement of Science note with sorrow the absence from our meetings of David Pearce Penhallow, long a member of the association and a year ago the vice-president for the Section of Botany. We shall miss his tall impressive figure, his kindly voice and his keen and discriminating discussion. We here inscribe upon the minutes of the Section of Botany this tribute to his worth, and request the council of the association to make an appropriate entry upon its record.

Upon motion of Professor Newcombe, it was unanimously voted to request the council to appoint a committee to investigate the conditions for research in the Bureau of Plant Industry.

The following officers were chosen:

Vice-president—Professor F. C. Newcombe.

Member of the Council—Professor F. C. Newcombe.

Member of the Sectional Committee (five years)—Professor L. H. Pammel.

Member of the Sectional Committee (one year, to fill the vacancy caused by the death of Professor Barnes)—Professor L. R. Jones.

Member of the General Committee—Professor C. E. Allen.

SPECIAL ADDRESSES

Imperfect Fungi as Causes of Wheat-sick Lands and of Deterioration in the Quality and Yield of Wheat: H. L. BOLLEY (abstract below).

The Organization of the Fruit-bodies of Hymenomycetes: A. H. REGINALD BULLER.

A Summary of Ecological Results from Colorado: FREDERIC E. CLEMENTS.

A South Sea Botanical Trip: JOSEPHINE E. TILDEN.

ABSTRACTS

The Work of Imperfect Fungi in Cereal Crop Deterioration: HENRY L. BOLLEY.

This paper gives an outline of experiments conducted at the North Dakota Agricultural College, dealing with the relation of the imperfect fungi in cereal cropping.

The essential conclusions may be summarized about as follows: the soils of the older wheat areas of the northwest are in the same sort of sanitary condition as the old flax-cropped lands and may quite properly be spoken of as wheat-sick or wheat-tired in the same sense as has previously been shown for flax lands. Wheat and other cereal lands are not necessarily depleted chemically as indicated by many agricultural and chemical writers, but may be only incapable of producing proper yields because of poor sanitary conditions in the soil or in the seed.

Soil and seed-born diseases have been and are the agents which vitiate the conclusions of many well-planned schemes of agriculture, as, for example, in fertilizer trials and crop rotations. These diseases, in large measure, account for the types of soil deterioration which agriculturists have had largely under discussion; much of the supposed improvement which has been described by such writers as applicable to special systems of cropping and of soil fertilizing have, in large measure, been due to bettered sanitary conditions rather than especially improved conditions as to soil fertility.

The genera of fungi which have been worked out as destructive to flax, wheat, oats and barley are found to belong to the old group of *Fungi imperfecti*. Of these the chief ones are *Helminthosporium*, *Colletotrichum*, *Fusarium*, *Macrosporium* and *Alternaria*.

There may be several species of each of these different genera at work. By cross infection, it is found that some of the kinds which attack wheat also attack barley. It is particularly interesting to note that practically all of the kinds which attack wheat also attack quack-grass. This accounts in large measure for the destructive influences which quack-grass has upon the development of the young cereal crop over quack-grass areas.

Chief among the lines of work which have en-

abled the investigators to arrive at definite conclusions, has been the development of a disease propagation garden whereby the struggle for existence of the crop plants against great odds has been carefully noted and the attacking plants observed.

In summarizing, attention is called to the bearings of these findings upon agriculture and upon the various lines of investigation. Proper consideration of sanitary methods of handling soil and seed will prove a great boon to cereal crop growers but in order to accomplish this, it may be necessary to rearrange the methods of fertilizing soils and our systems of crop rotations. These observations regarding the persistence of disease in the seed and in the soil will, of necessity, materially change our ideas as to why one crop does better after than before some other crop. These observations, it is thought, explain many of the anomalies of farm cropping: why certain methods of manuring result in shrivelling of seed wheat; why the attacks of rust are so destructive; why proper seed treatment has always resulted in better yields than could be explained by the presence or absence of smut alone; why the corn crop has proved to be such a beneficial crop to precede wheat, etc.

In closing, attention is called to the extensive work of the Bureau of Soils of the Department of Agriculture upon so-called toxins in the soil; the troubles which they describe may not, of necessity, rest primarily in the soils. Before material progress is made in the amelioration of conditions of cereal agriculture, proper consideration of soil and seed sanitation will prove to be the center about which great modifications in our present methods of agriculture must be shaped.

The Succession of Vegetation in Ohio Lakes and Ponds: Alfred Dachnowski.

Along the line of "watersheds" in Ohio are a number of lakes and ponds in various stages of "filling." Almost throughout, the surface vegetation is one that is common to bogs. In relatively undisturbed areas there is a zonal arrangement. An attempt is made at a classification of the formations, and a formulation of the laws of succession involved in the comparative study.

Forest Dynamics on Isle Royale, Lake Superior: William S. Cooper.

The dominant forest of Isle Royale is composed mainly of three tree species—balsam fir, paper birch, white spruce. The relations of these to each other are as follows: Spruce and birch form a small proportion of the forest if all ages are considered, but a large proportion of the mature stand. The few large trees of these species are very conspicuous, while young ones are hard to find. Balsams of all sizes, especially small, are exceedingly numerous. The appearance is therefore of rapid succession, the balsam succeeding the other species.

Quadrat studies of selected areas, with the ages of all trees in the quadrats determined, shows that this appearance is deceptive. The forest as a whole is in equilibrium, but a given area is continually changing in composition and in the relative proportions of the different tree species. The changes are due primarily to the fact that all three species require considerable light during their early stages. One generation in a given area prevents reproduction until maturity or some accidental cause brings about its destruction. Windfall, by allowing light to reach the ground, is the commonest cause of the beginning of a new generation. In windfall areas young tree growth soon springs up, usually predominantly balsam, owing to the ready germination of this species. Balsam never becomes predominant in the mature stand, in spite of high reproduction, because of high mortality. The reproduction of birch and spruce is low, but their mortality is also low.

The result of these processes is that equilibrium is maintained in the forest as a whole. The dominant forest is therefore the Climax Forest of the island.

Observations on the Underground Stems of Symplocarpus and Lysichiton: C. O. Rosendahl.

The underground stems of *Symplocarpus fœtidus* and *Lysichiton camtchatcense* are true sympodia, although the fact is not readily perceived on account of their thickness. They grow very slowly, adding only from 3–8 mm. to their length yearly.

On full-grown plants, five to six renewal shoots, or joints, of the sympodium are produced each year. In *Symplocarpus* each renewal shoot or joint bears two foliage leaves, a spathe and an inflorescence. In *Lysichiton* each joint bears in addition two bracteal leaves, and the last 1–3 leaves in the fall are much reduced foliage leaves, *i. e.*, green leaves with very small laminæ; in *Symplocarpus* the first 2–3 leaves to appear in the spring are scale leaves.

Symplocarpus sends up and matures only 1–2 inflorescences a year. The others become arrested and remain in between the broad bases of the foliage leaves. *Lysichiton*, on the other hand, matures from 2–4 inflorescences yearly.

The habit of these two aroids in producing from 2–5 inflorescences in excess of the number they are capable of maturing each year is to be explained in the light of their tropical origin and in their previous more southerly range.

Some Effects of Severe Freezing upon Vegetation in a Condition of Active Growth: F. K. BUTTERS and C. O. ROSENDAHL.

On the night of April 15, 1910, the temperature at Minneapolis fell to 27° F., and a week later to 19° F. with a high wind. At the time of these frosts vegetation was in an advanced state, many trees were in full leaf, and nearly all others in active growth. Observations were made upon about seventy species of woody and herbaceous plants. It was found that besides the injury due directly to cold, much mechanical injury resulted from loss of turgidity in succulent young shoots during the early stages of freezing, and from the extreme brittleness of hard frozen leaves and twigs which the wind snapped off in great numbers. The second freeze injured many plants which were not hurt by the first one. About 42 per cent. of woody species lost practically all their foliage, only about 10 per cent. were relatively uninjured. Mature leaves and those just unfolding from the bud were less injured than half-grown leaves of the same plant. In about 60 per cent. of the species the twigs of the new growth were killed or severely injured. In about 15 per cent. the twigs of the past season's growth, and in a few instances older twigs, were injured. Flower buds were somewhat more tender, open flowers and fruits much more tender than vegetative parts. Damage to native herbaceous plants was mainly mechanical, and relatively slight except in the case of open flowers and fruits. A few weeks afterwards herbaceous vegetation appeared normal while woody plants had just begun to recuperate. The most usual types of recuperation in trees and shrubs were: (1) when the twigs were uninjured and the terminal bud intact, this often made a further growth bearing a new crop of leaves; (2) when the outer parts of the new twigs were destroyed while the basal parts remained intact, lateral shoots often arose from the leaf axils of these uninjured portions either with or without the intervention of scaly buds; (3) many latent buds started into growth upon the woody twigs, sometimes upon those several years old. In some cases all these methods of recuperation appeared in the same plant.

Color Photography in Botanical Work: FRANCIS RAMALEY.

Botanists can make use of the new color photography especially in studies of ecology and plant breeding. Many features of vegetation are brought out much more clearly than by ordinary photography. Thus, a moor with scattered shrubs or a lake-margin surrounded with belts of different plants can be well shown. In plant-breeding experiments the appearance of the different hybrids and extracted forms can be reproduced with much faithfulness. Colored plates from books are easily reproduced upon lantern slides. The exposure required is about 200 times that for an extra rapid isochromatic plate. Hence no "snap shots" can be taken, but if the light is good there need be no difficulty in securing good results. Development can be carried out in an ordinary dark room. The solutions used are inexpensive and easily prepared.

Respiration (CO_2 Production) in Air, in Nitrogen and in Hydrogen: B. M. DUGGAR and GEORGE R. HILL, JR.

The experiments reported give data respecting the rate, continuance and decline of anaerobic respiration (CO_2 production) in nitrogen and hydrogen as compared with aerobic respiration under otherwise similar conditions. The plant materials used were slices of sugar beet and germinating seed. Special attention is also drawn to the importance of an available nitrogen supply for other physiological purposes.

The Flora of the Olympic Peninsula, Washington: ALBERT B. REAGAN.

The Olympic peninsula in northwest Washington comprises a wide coastal strip bordering on the Pacific Ocean, the Strait of Juan de Fuca and Puget Sound, surrounding a totally isolated, central high area termed the Olympic Mountains. These occupy an eroded domed area in the east central part of the peninsula, with a western limb extending in declining altitude to Cape Flattery. The peaks in the central area range from 6,000 to 8,130 feet in height, Mount Olympus being the highest peak. The domed surface causes a radial drainage in all directions, but the larger streams flow into the Pacific.

This peninsula with its lofty peaks stands first in the path of the moisture-bearing southwesterly winds from the Pacific, hence the precipitation is great; at the coast it is usually rain, in the mountains snow. The precipitation averages 40 inches north and east of the mountains; west of the mountains at an elevation of 3,000 feet, about 80 inches; and in the Pacific and upper-Strait-Flattery region, 100 to 120 inches. The climate,

also, is controlled by the prevailing warm winds from the western ocean; at the coast line snow is seldom seen.

Under such an equable climate and abundance of rainfall, the peninsula, with few exceptions, is the most densely forested region in our country; and smaller plants do equally well. Of course as one approaches the mountains the forest becomes less dense till the timber line is reached; but in the reverse proportion the flowering herbs at the same time increase in number and beauty. The region in the lower levels is a jungle of trees, shrubs and entangled vines.

About 200 square miles of the timbered area has been burned over; 260 square miles is naturally timberless, lying just at timber line; and 150 square miles consist of ice and rocks.

The most conspicuous plants of the peninsula are red fir (*Pseudotsuga taxifolia*), lovely fir (*Abies amabilis*), subalpine fir (*Abies lasiocarpa*), white pine (*Pinus monticola*), red cedar (*Thuja plicata*), Alaska cedar (*Chamæcyparis nootkatensis*), Sitka spruce (*Picea sitchensis*), Merten's hemlock (*Tsuga Mertensiana*), vine maple (*Acer circinatum*), maple (*Acer macrophyllum*), alder (*Alnus oregona*), cottonwood (*Populus trichocarpa*), dogwood (*Cornus Nuttallii*), thimble berry (*Rubus parviflorus*), salmon berry (*R. spectabilis*), raspberry (*R. leucodermis*), red elderberry (*Sambucus callicarpa*), red huckleberry (*Vaccinium parvifolium*), salal (*Gaultheria shallon*), Oregon grape (*Berberis nervosa*), fireweed (*Epilobium spicatum*), bracken fern (*Pteridium*), blue huckleberry (*Vaccinium ovalifolium*) and devil's club (*Echinopanax horridum*).

Of the plants of the region, the most conspicuous are the forest trees, which here reach gigantic proportions. Principal among these are fir, spruce, hemlock and cedar ranging from 200 to 400 feet in height, 80 feet clear of limbs, and from 10 to 13 feet in diameter, or more (the cedars ranging from 30 to even 50 feet in some instances). Intermingled with these trees is a profusion of shrubbery so dense in the coast districts that it is difficult to traverse the region. The estimated timber aggregates more than 70,000,000 M. feet B.M., or enough timber to supply the entire United States's demand for more than two years.

The plants so far identified in the peninsula number 689.

Twin Hybrids in Œnothera, with a Suggestion concerning their Explanation: R. R. Gates.

A large number of crosses were made, confirming in general the type of behavior in *Œnothera* called by de Vries twin hybrids, and adding new crosses which have not previously been made. When a member of the *Onagra* group of species of *Œnothera* is pollinated by *O. Lamarckiana* or one of its mutants, two types are produced known as *lœta* and *velutina*, the former having broad and smooth leaves, the latter narrow, furrow-shaped and hairy leaves. These types resemble each other in the different crosses, and both usually breed true. There is a similar dimorphism in cultures of *O. lœvifolia*, broad-leaved and narrow-leaved types occurring. In cultures of forms which probably belong to *O. muricata* (having smaller flowers than *O. biennis*), from wild seeds collected in Nova Scotia, at St. John, N. B., and at Winnipeg, a similar dimorphism is found to occur, *i. e.*, broad-leaved and narrow-leaved types, although the races do not all agree in other particulars. The Winnipeg plants came from seeds of one individual. There is therefore a marked dimorphism of some of the forms in the wild condition, and this may account for the occurrence of similar twin types in crosses in which *O. biennis* is the female parent, the condition being transmitted in the eggs, but not usually through the pollen.

The Sand-dune Flora of Iowa: B. Shimek.

A discussion of the distribution and the physiographic features of the limited dune areas of the state is given. The flora of the sand dunes is presented and the fact is brought out that while a limited number of species may be considered as characteristic of the dunes, the greater part of the flora is identical with that of the drier prairies.

On the Relation of the Living Cells to Transpiration and Sap-flow in Cyperus: James Bertram Overton.

Experiments in which cut stems of *Cyperus* are placed in water show that withering occurs sooner than when a certain portion, not to exceed 20 cm., has been killed with steam and the killed stems left in connection with the roots. When 20 cm. of the stem are killed with steam the leaves wither in about eight days, or in about the same time as control plants. It has been found that the longer the portion killed by steam the sooner the leaves above wither and dry. When 25–30 cm. of the stem are killed with steam, the leaves wither in three to five days, no matter how long the section killed with steam may be. The leaves on steamed stems never wither quite so quickly

as those on stems cut and placed in water, but under the same conditions of light, temperature and air moisture. In this plant sufficient water to keep the leaves turgid for three to eighteen days will rise through a stem 15–60 cm. high, with a section 5–60 cm. long killed with steam. Experiments show that a certain amount of water is raised through the steamed portions, but that it gradually diminishes in quantity from day to day, until the leaves become air dry. The diminished water supply is partly due to a partial blocking of the vessels with a gum-like substance, which probably owes its origin to the disorganization of the contents of the sieve tubes caused by heating the stems. The withering of the leaves above the steamed portion is probably caused by the action of deleterious substances introduced into them from the dead cells more than from lack of water. The poisonous substances are probably disorganization products caused by steaming the stems. The withering leaves above a steamed portion of the stem show all of the symptoms of dying, namely, rapid loss of water directly after treatment, then a more uniform loss, rounding up and discoloration of the chloroplasts and contraction of the protoplasts. The leaves apparently die, not so much from lack of water supply, as on account of the death of the cells from other causes. It is evident from experiments that the steaming method of killing portions of the stems is not a satisfactory one in order to settle the question of the relation of the living cells to sap-flow. Other methods have been used. Killing a portion of the stem by applying wax heated to 110° C. causes less apparent disorganization of the cells of the stems, less injury to the leaves above and does not cause a marked immediate decrease in the amount of transpiration.

An Undescribed Type of Elodea Flower: ROBERT BRADFORD WYLIE.

An unusual (and apparently undescribed) type of staminate flower was collected by the writer from East Okoboji Lake, Iowa, during the summers of 1909 and 1910. In this strain, which occurs abundantly in the locality, the axis of the staminate flower elongates rapidly at maturity, pushes out of the spathe and carries the pollen-bearing flower to the surface of the water, where it opens still attached to the plant. The degree of elongation may be as great as in the pistillate flower. While the general appearance of the two flowers is similar, and the habits of reaching the surface of the water are biologically alike, the parts concerned are not homologous. The elongated portion of the staminate flower is the axis below the floral parts, while that of the pistillate flower is the complex above the ovary in epigynous flowers called the "floral tube." In the opinion of the writer the form deserves specific rank, and the name *Philotria Iowensis* (*Elodea Iowensis*) is proposed.

The Flora of a Saline Lake: M. A. BRANNON.

This report is based upon a study of Devil's Lake, situated in Benson and Ramsey counties, North Dakota. It is a saline lake in the lowest portion of an inland drainage basin comprising about 4,000 square miles. The lake has lowered about 14 feet within 27 years with the attendant results of receding shore line, separation of the former lake into divisions and an increase in the salinity of the water.

Waves and the longitudinal and vertical currents cause thorough and rapid distribution of the phyto-plankton in which representatives of the Myrophyceæ predominate.

Ruppia maritima is the only spermatophyte found in Devil's Lake. It grows in profusion on submerged terraces along shores protected by high land terraces.

Enteromorpha prolifera, various species of *Cladophora,* and some of the Protococcales are the only Clorophyceæ found in this saline lake.

A study of ecological factors has been conducted with reference to pulsation in plant multiplication and in connection with inhibition of plants growing in adjacent bodies of sweet water.

Nodularia spumigens var. *litoria* gave the following record: May 29, 1910, there were three to five per cubic centimeter, August 18 there were several hundred filaments per cubic centimeter and on November 1 only two to three per cubic centimeter.

This pulsation was believed to be caused largely by the increased heat. The temperature readings on May 29 were 14° C., August 18 20° C. and November 1 11° C. The maximum portion of the curve was coincident with increased light action and increased wave and current action of the lake.

Spirogyra and *Chara* were used in the inhibition experiments and the results indicate that loss of turgidity when immersed in saline solutions was largely responsible for the non-existence of these and other forms in Devil's Lake. *Enteromorpha* and *Cladophora* are capable of standing ten to thirteen per cent. salt solutions, according to Oltmanns, hence these forms are not inhibited

from Devil's Lake but are present in great quantities. Detailed physical and chemical experiments await further investigations, but present information does not indicate that the toxic action of salts is responsible for the Devil's Lake inhibition of plant forms growing in bodies of sweet water adjacent to Devil's Lake.

Nuclear Phenomena in the Basidium and in the Germinating Spores of Dacrymyces and Tremella: E. M. GILBERT.

The discovery of the fusion of two nuclei in the basidium and the further fact that the cells from which the basidia arise are binucleate, has made it of vital interest to discover the origin of this binucleate condition. The writer finds that the spores of certain species of *Dacrymyces* and *Exidia* are uninucleate and become in germination, successively two, four and eight celled, each cell being uninucleate. Germ tubes are then developed and a mycelium formed, the cells of which have a single nucleus. The binucleate condition does not then arise at the germination of the spore or in the young mycelium. Dangeard, Perrot and Maire find that the subhymenial cells of various forms are binucleate. The writer finds a nuclear fusion in the young basidia of *Exidia albida* and *Dacrymyces* sp. The double division of the fusion nucleus in species of *Exidia* and *Tremella* studied, suggests, in many of its features, that chromosome reduction occurs at this stage. Synapsis and diakinesis are well marked stages. The two spored basidia of *Dacrymyces* as noted by Juel and Dangeard raise an interesting question as to the method of reduction in this form.

The Organization of the Chromosomes in Carex: A. B. STOUT.

The visible structures in the resting nuclei in the root tip of *Carex aquatilis* and their behavior throughout mitosis make it plain that here the chromosomes are permanent individuals which can be identified not only in resting nuclei, but throughout the entire process of nuclear and cell division, except for a short time during the diaster stage when they are closely massed together.

The chromosomes are also arranged in a definite serial place relationship which is preserved throughout the late prophases and the equatorial plate stage. There is thus maintained throughout all stages of division a definite relative position of the chromosomes.

The spheroidal shape of the chromosomes is quite constant and uniform. There is, however, marked growth in their volume during early prophases until they reach their maximum size, which varies from 0.3 μ to 0.4 μ in diameter. This rather constant spheroidal shape facilitates the identification of the individual chromosomes throughout the various stages. At one stage in the late prophases the chain of chromosomes is tightly coiled about the nucleole.

This behavior of the chromosomes in *Carex* gives positive evidence in support of the view that chromosomes are permanent individuals with a definite and permanent relative arrangement in the nucleus.

The following papers were read by title:

The Relation of Aspergillus niger, Penicillium digitatum and other Organisms to Tannic Acid Fermentation: LEWIS KNUDSON.

Some Problems in the Breeding of Sugar Beets: C. O. TOWNSEND.

The Oxygen Minimum and the Germination of Xanthium Seeds: CHARLES ALBERT SHULL.

Evaporation Studies in the Sand Dune Plant-associations of Lake Michigan and in the Beech Forest: GEORGE D. FULLER.

Studies of Castilla Seedlings: PEHR OLSSON-SEFFER.

Some Experiments on the Colors of the California Poppy: PEHR OLSSON-SEFFER.

Some Physiological Conditions in the Culture of Spirogyra: W. D. HOYT.

On the Character of the Resin-tissue of the Araucarineæ and the Podocarpineæ: R. B. THOMSON.

The Antheridia of the Laboulbeniaceæ: J. H. FAULL.

Homothallic Conjugation in Rhizopus: FLORENCE A. MCCORMICK.

HENRY C. COWLES
THE UNIVERSITY OF CHICAGO

THE AMERICAN SOCIETY OF ZOOLOGISTS CENTRAL BRANCH

THE annual meeting of the American Society of Zoologists, Central Branch, was held in conjunction with Section F of the American Association for the Advancement of Science in Pillsbury Hall of the University of Minnesota, Minneapolis, Minn., on December 28, 29 and 30, 1910, Professor C. E. McClung, of the University of Kansas, presiding.

The committee on nomenclature appointed at the Iowa City meeting reported that it was making progress in the formulation of a plan